

336d New Biobased Nanocomposite Materials from Toughened Bacterial Bioplastic and Titanate Modified Clay

Yashodhan S. Parulekar and Amar K. Mohanty

Biobased/green nanocomposites are wave of the future. Polyhydroxybutyrate (PHB), a bacterial bioplastic is recently highlighted because of its renewable resource based origin and it's potential to substitute petroleum derived non-biodegradable plastic like polypropylene (PP). The major drawback of PHB is its brittleness. This work investigates toughening mechanisms for PHB via incorporation of elastomeric components. Maleated polybutadiene with high grafting and low molecular weight was identified as the compatibilizer. The resulting toughened PHB showed exceptional improvement in impact strength over pure PHB with minimal loss in modulus. The loss of modulus was recovered to permissible extent through incorporation of titanate modified montmorillonite clay. The hydrophilic clay was modified by titanate-based treatment to make it organophilic. Such surface modification is validated through coordinated characterization techniques that include X-ray photoelectron spectroscopy (XPS), contact angle measurements, X-ray diffraction (XRD) and thermo gravimetric analysis (TGA). The toughened PHB and its nanocomposites were characterized by rheological, thermo-mechanical and morphological analysis (AFM, TEM, ESEM and PLM). Takayanagi and Halpin Tsai models were used to model the behavior of the materials and experimental results showed significant correlation with the predictions. This research is financially supported by EPA-STAR 2002 award # R830904.